Lab 4. Methods

Homework

The homework for this week consists of 10 multiple choice questions organised as a test in eLearning. You need to answer them online, via eLearning. Login to eLearning, go to ***Course Material*** (left panel) and click on the link ***w4-homework*** to start the online test (homework). And you already know the rules and hints:

1. Do not delay the submission of the homework till the very last moment as eLearning may get overloaded and you may miss the deadline! You will not be able to submit after the deadline.

2. If you have problems submitting in eLearning before the deadline, email your answers to sit.info1103@sydney.edu.au (e.g. 1A, 2B, etc.).

3. You are allowed 2 attempts. If you submit twice, the second attempt will be marked.

4. Incomplete submissions are not valid submissions and are ignored. An incomplete submission is a submission started before the deadline but not submitted before the deadline. Only complete (valid) submissions are marked. Start working on the homework early so that you can finish it before the deadline, and remember to press "Submit"!

Here are the questions for your information (remember that they must be answered online via eLearning):

1. Consider the method `square()`:

```
public static String square(int a)
{
   return ("Commencing");
}
```

Which option is a legal invocation of this method?

A) `int a = square(4);`
B) `String a = square("help");`
C) `double a = square(4.0);`
D) `String a = square(4);`

2. Consider a method named `calc`, which accepts two numbers as integers and returns their sum as an integer. Which of the following is the correct statement to invoke this method?

A) `calc(2, 3.14);`
B) `int sum = calc(2, 3);`
C) `calc();`
D) `int sum = calc("2", "3");`

3. What is the problem with the code below?

```
public static String val()
{
   String result = "cake";
   return;
}

. . .

// Using method val()
System.out.println("The value is: " + val());
```

A) The method `val` does not have a return value.
B) The method `val` does not have any parameter variables.
C) The use of `val` in the `System.out.println` statement is illegal.
D) The `String` data type cannot be returned from a method.

4. Which of the following is true?

A) Methods can have only one argument and can return only one return value.
B) Methods can have multiple arguments and can return multiple return values.
C) Methods can have multiple arguments and can return one return value.
D) Methods can have one argument and can return multiple return values.

5. What is the error in the following method definition?

```
public static void findMin(int x, int y)
{
   int min = 0;
   if (x < y)
   {
      min = x;
   }
   else
   {
      min = y;
   }
}
```

A) The method returns the maximum instead of the minimum of the two arguments.
B) The method does not return a value.
C) The method returns 0 if the first and second arguments are equal.
D) The method does not specify a type for the second argument.

6. What is the syntax error in the following method definition?

```
public static String parameter(double r)
{
   double result;
   result = 2 * 3.14 * r;
   return result;
}
```

A) The method does not return the value `result`.
B) The method does not specify the `result` return type.
C) The variable `result` is set but never used.
D) The value that is returned does not match the specified `return` type.

7. What are the values of `num1` and `num2` and `result` after executing the code below?

```
public static int mystery (int firstNum, int secondNum)
{
   firstNum = firstNum * 2;
   secondNum = secondNum * 3;
   return firstNum + secondNum;
}

public static void main(String[] args)
{
   int num1 = 10;
   int num2 = 11;
   int result = mystery(num1, num2);
}
```

A) num1 = 20, num2 = 33 and result is 53
B) num1 = 10, num2 = 11 and result is 53
C) num1 = 0, num2 = 0 and result is 0
D) num1 = 20, num2 = 33 and result is 0

8. What is wrong with the following code?

```
public static char grade(int score)
{
   if (score >= 9)
   {
      return 'A';
   }
   else if (score >= 8)
   {
      return 'B';
   }
   else if (score >= 6)
   {
      return 'C';
   }
   else if (score > 4)
   {
      return 'D';
   }
   else if (score < 4)
   {
      return 'F';
   }
}
```

A) Illegal parameter variable name
B) Invalid parameter variable type
C) No `return` statement for all logic paths
D) Invalid argument in `return` statements

9. Which of the following is the best choice for a return type from a method that prompts users to enter their password and returns this password?

A) `char`
B) `int`
C) `String`
D) `void`

10. The purpose of a method that returns `void` is:

A) To satisfy compiler warnings
B) To bundle together a repeated task as a method even though the task does not return a value
C) To force a value to be returned in case the `return` statement is forgotten
D) To insert a temporary implementation of a method that can be refined later

Reminders and announcements

1. A reminder (for the last time): For the exercises below, remember to create a package `lab4` in the `Labs` project. Then, for each exercise, create a class within this project and this package.

2. You can see that the programs that we write are becoming longer and more complex. This week is the last time when we will provide the lab solutions embedded in the pdf solutions file. From next week, we will make the lab solutions available as a zip file that you can directly import in Eclipse.

1. Area of a rectangle

Write a method called `calculateArea` that takes two parameters, the length and width of a rectangle, and returns the area of the rectangle. The header and `javadoc` comments for this method are:

```
/**
      Computes the area of a rectangle, given its length and width.
      @param length the length of the rectangle
      @param width the width of the rectangle
      @return the area of the rectangle
   */
   public static double calculateArea(double length, double width)
```

Write a `main` method that creates two variables of type `double` corresponding to the sides of a rectangle, then calls the method `calculateArea` (write this method too) and prints the length, width and area of the rectangle.

2. Even and odd numbers

Given is the following skeleton code that uses the method `isEven` from the lecture.

```
/**
 * This program contains a method that prints all numbers in a range
 * and whether each one is odd or even
 * @author Irena Koprinska <replace with your name>
 */
```

```
public class EvenAndOddNumbers
{

	public static void main(String[] args)
	{
		int firstNumber = 6;
		int lastNumber = 12;
		printNumbers(firstNumber, lastNumber);
	}

	/**
	 * Prints all numbers between the 2 given numbers (inclusive),
	 * and whether they are odd or even
	 */
	public static void printNumbers(int low, int high)
	{
		// complete this method
	}


	/** Prints if an integer number is even or odd
	 *  @param n number to test
	 */
	public static void isEven(int n)
	{
		// A number is even if when divided by 2 the reminder is 0
		if (n % 2 == 0)
			System.out.println(n + " is even");
		else
			System.out.println(n + " is odd");
	}
}
```

Write the method `printNumbers`. It should:

1) Use the method `isEven` to print all integer numbers between low and high (inclusive) and whether they are even or odd, e.g. `printNumbers(6,12)` will print:

```
6 is even
7 is odd
8 is even
9 is odd
10 is even
11 is odd
12 is even
```

2) If `low` is bigger than `high`, it should swap the values, i.e. `printNumbers (12,6)` should produce the same output as `printNumbers(6,12).`

   Hint: swapping the values of two variables is a three step process.

3. Three numbers

Write the following two methods (with `javadoc` comments):

- `public static double smallest(double x, double y, double z)` that returns the smallest of the arguments
- `public static double average(double x, double y, double z)` that returns the average of the three arguments

Write a `main` method that asks the user to enter three numbers, calls the two methods above and prints the sum and average as in the examples below:

```
Enter three numbers:
1
3
8
The smallest number is: 1.0
The average of the numbers is: 4.0


Enter three numbers:
15.5
3.8
9.6
The smallest number is: 3.8
The average of the numbers is: 9.633333333333333
```

4. Number of words

Write the method `public static int countWords(String str)` that returns the number of words in the string `str`. You can assume that the words are separated with one space. For example, `countWords("The quick brown fox jumps over the lazy dog")` should return 9.

Write a `main` method that asks the user to enter a sentence and then prints the number of words in it, e.g.:

```
Enter a sentence:
The quick brown fox jumps over the lazy dog
The number of words is 9

Enter a sentence:
Mary has a little lamb
The number of words is 5
```

Hint: Use the method `charAt`.

5. Triangle

Write a method `public static void printTriangle(int n)` that takes an integer parameter `n` between 1 and 9 and prints a triangle of numbers, where the top row contains the numbers from `n` down to 1, from left to right, and each number is the same as the number directly above it. The numbers are separated by spaces and the triangle is right-aligned. For example, for `n` =4 your method should print:

```
4 3 2 1
  3 2 1
    2 1
      1
```

Write a main method that calls `printTriangle(int n)` with two different parameters. Write appropriate comments (always do this, for all exercises).

6. Challenge question 1

Write a method `public static void checkPrime(int n) that` checks if `n` is a prime number or not. To test this, use the *trial division* method as described in: http://en.wikipedia.org/wiki/Prime_number. According to this method, it is sufficient to test if *n* is a multiple of any integer between 2 and $\sqrt{n}$. If so, *n* is not a prime number, otherwise it is.

Write a main method that first asks the user to enter a number and then calls `the checkPrime` method to print the result. A sample output is here:

```
Enter a number:
23
The number 23 is prime

Enter a number:
16
The number 16 is not prime
```

7. Challenge question 2

It is a well-known phenomenon that most people are easily able to read a text whose words have two characters flipped, provided that the first and last letter of each word are not changed, e.g.:

I dn’ot give a dman for a man that can olny sepll a word one way. (Mrak Taiwn)

Write a method `public static String scramble(String word)` that takes a word and returns a scrambled version of it, by randomly selecting two characters that are not the first and last one and swapping them. If the word contains 3 or less characters, it should be returned unchanged.

Then write a `main` method that produces the following output:

```
Enter words to scramble, one per line, or "end" to quit:
holiday
halidoy
java
jvaa
music
misuc
end
Goodbye!
```

Hint: To select the characters for exchange, use the method `Math.random()` which generates a random number between 0 and 1 (exclusive) and multiply it by appropriate number depending on the length of the word. For example, (int) (`Math.random()*6`) generates random numbers between 0 and 5; note the casting to `int.` Select the position of the first character `pos1` randomly between the first and last character. Then select the position of the second character `pos2` between pos1 and the last character.